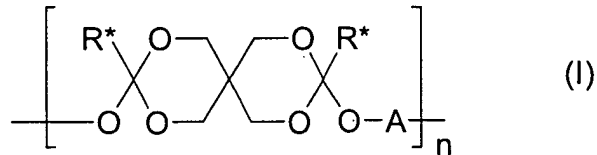


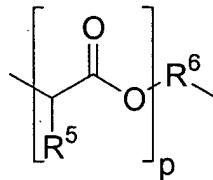
WHAT IS CLAIMED IS:

1. A polyorthoester of formula I:

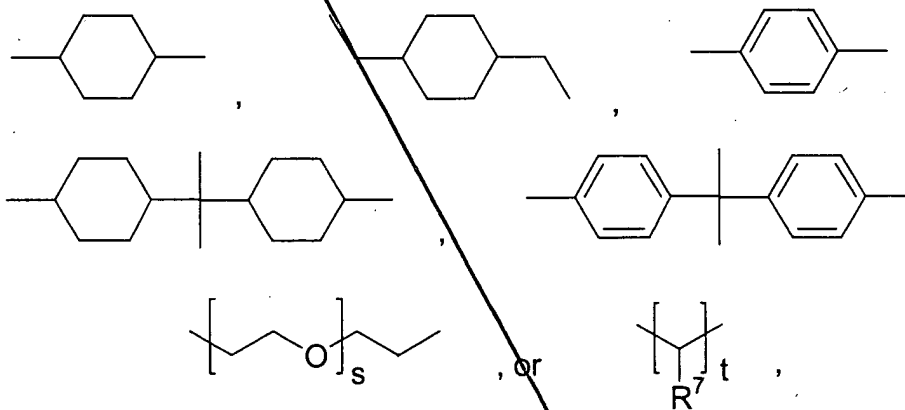


where:

- 5 R\* is a C<sub>1-4</sub> alkyl;  
n is an integer of at least 5; and  
A is R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, or R<sup>4</sup>, where  
R<sup>1</sup> is:



- 10 where:  
p is an integer of 1 to 20;  
R<sup>5</sup> is hydrogen or C<sub>1-4</sub> alkyl; and  
R<sup>6</sup> is:

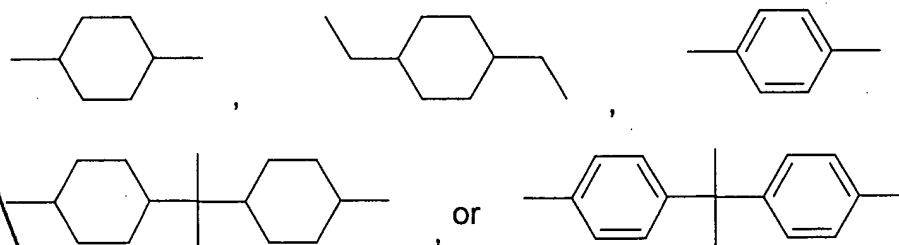


- 15 where:  
s is an integer of 0 to 30;

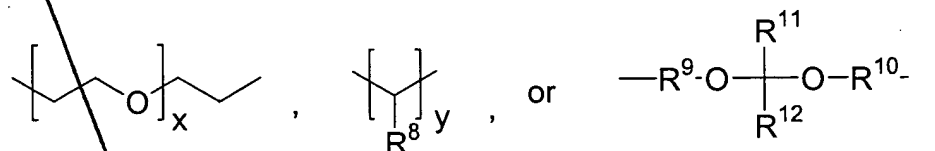
t is an integer of 2 to 200; and

$R^7$  is hydrogen or  $C_{1-4}$  alkyl;

$R^2$  is:



5  $R^3$  is:



where:

$x$  is an integer of 0 to 30;

$y$  is an integer of 2 to 200;

10  $R^8$  is hydrogen or  $C_{1-4}$  alkyl;

$R^9$  and  $R^{10}$  are independently  $C_{1-12}$  alkylene;

$R^{11}$  is hydrogen or  $C_{1-6}$  alkyl and  $R^{12}$  is  $C_{1-6}$  alkyl; or  $R^{11}$  and  $R^{12}$  together are  $C_{3-10}$  alkylene; and

$R^4$  is a diol containing at least one functional group independently selected from amide, imide, urea, and urethane groups;

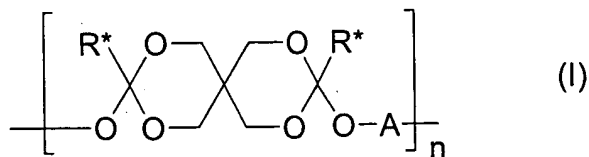
15 in which at least 0.1 mol% of the A units are  $R^1$ , and at least 0.1 mol% of the A units are  $R^4$ .

2. The polyorthoester of Claim 1 where  $n$  is about 5 to about 1000.

3. The polyorthoester of Claim 2 where  $n$  is about 20 to about 500.

4. The polyorthoester of Claim 3 where  $n$  is about 30 to about 300.

5. The polyorthoester of Claim 1 which comprises about 1 to about 50 mole percent of units in which A is  $-O-R^1-$ .
6. The polyorthoester of Claim 5 which comprises about 2 to about 30 mole percent of units in which A is  $-O-R^1-$ .
7. The polyorthoester of Claim 6 which comprises about 5 to about 30 mole percent of units in which A is  $-O-R^1-$ .
8. The polyorthoester of Claim 7 which comprises about 10 to about 30 mole percent of units in which A is  $-O-R^1-$ .
9. The polyorthoester of Claim 1 where p is 1 to 6.
10. The polyorthoester of Claim 9 where p is 1 to 4.
11. The polyorthoester of Claim 10 where p is 1 to 2.
12. The polyorthoester of Claim 1 where  $R^4$  is hydrogen or methyl.
13. The polyorthoester of Claim 1 which comprises up to about 20 mole percent of units in which A is  $-O-R^2-$ .
14. The polyorthoester of Claim 1 which comprises about 60 to about 99.9 mole percent of units in which A is  $-O-R^2-$ .
15. The polyorthoester of Claim 1 where q is 1 to 6.
16. The polyorthoester of Claim 15 where q is 1 to 3.
17. A process of preparing a polyorthoester of formula I:



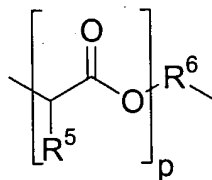
where:

R\* is a C<sub>1-4</sub> alkyl;

n is an integer of at least 5; and

5 A is R<sup>1</sup>, R<sup>2</sup>, R<sup>3</sup>, or R<sup>4</sup>, where

R<sup>1</sup> is:

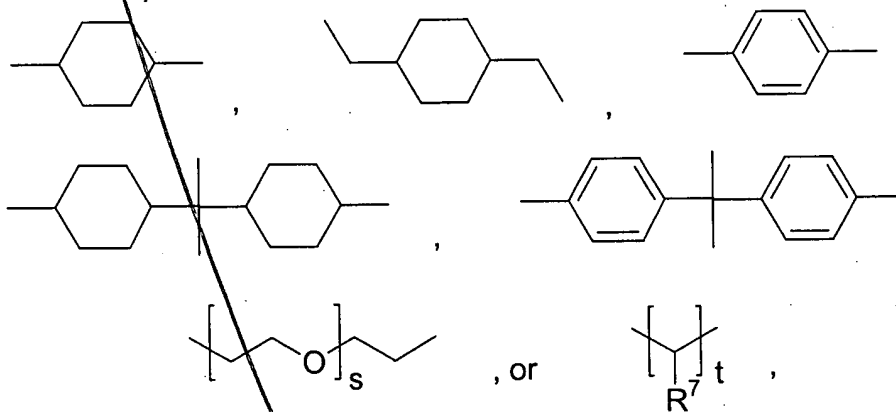


where:

p is an integer of 1 to 20;

10 R<sup>5</sup> is hydrogen or C<sub>1-4</sub> alkyl; and

R<sup>6</sup> is:



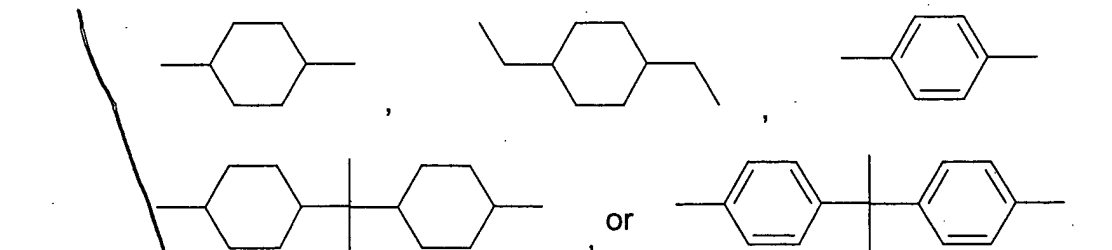
where:

s is an integer of 0 to 30;

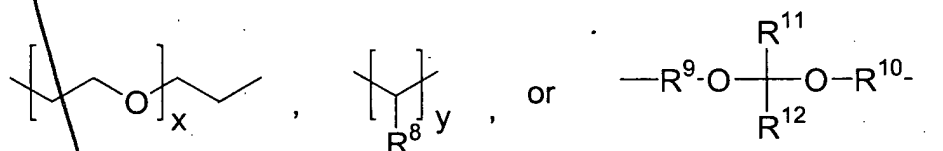
15 t is an integer of 2 to 200; and

R<sup>7</sup> is hydrogen or C<sub>1-4</sub> alkyl;

R<sup>2</sup> is:

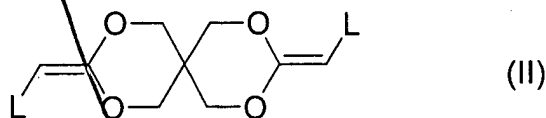


R<sup>3</sup> is:



where:

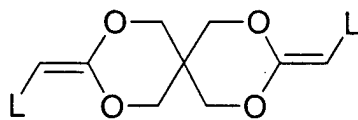
- 5 x is an integer of 0 to 30;  
 y is an integer of 2 to 200;  
 R<sup>8</sup> is hydrogen or C<sub>1-4</sub> alkyl;  
 R<sup>9</sup> and R<sup>10</sup> are independently C<sub>1-12</sub> alkylene;  
 R<sup>11</sup> is hydrogen or C<sub>1-6</sub> alkyl and R<sup>12</sup> is C<sub>1-6</sub> alkyl; or R<sup>11</sup> and R<sup>12</sup> together are C<sub>3-10</sub> alkylene; and  
 10 R<sup>4</sup> is a diol containing at least one functional group independently selected from amide, imide, urea, and urethane groups;  
 in which at least 0.1 mol% of the A units are R<sup>1</sup>, and at least 0.1 mol% of the A units are R<sup>4</sup>,  
 the process comprising reacting a diketene acetal of formula II:



- 15 where L is hydrogen or a C<sub>1-3</sub> alkyl,  
 with a diol of the formula HO-R<sup>1</sup>-OH and a diol of the formula HO-R<sup>4</sup>-OH, and optionally at least  
 one diol of the formulae HO-R<sup>2</sup>-OH and HO-R<sup>3</sup>-OH.

18. A polyorthoester that is the product of a reaction between:

- 20 (a) a diketene acetal of formula II;

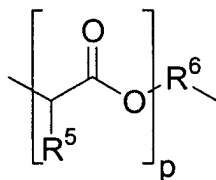


(II)

where L is hydrogen or a C<sub>1-3</sub> alkyl, and

(b) a polyol or mixture of polyols in which at least 0.1 mole percent of the total polyol content is a diol of the formula HO-R<sup>1</sup>-OH, where

5 R<sup>1</sup> is:

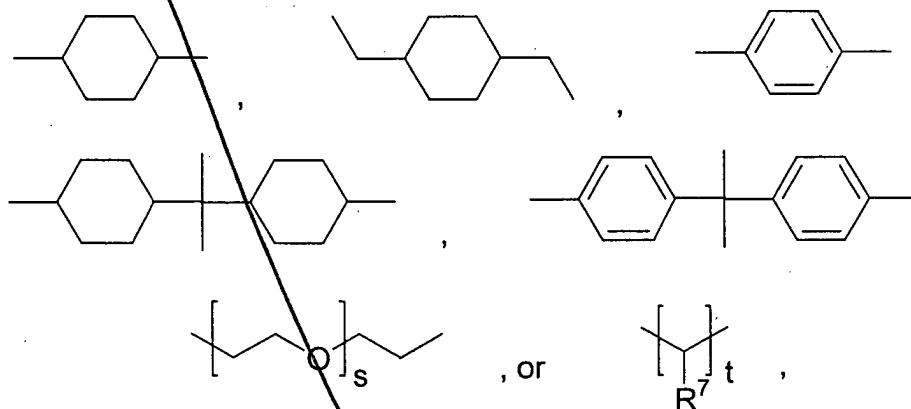


where:

p is an integer of 1 to 20;

R<sup>5</sup> is hydrogen or C<sub>1-4</sub> alkyl; and

10 R<sup>6</sup> is:



where:

s is an integer of 0 to 30;

t is an integer of 2 to 200; and

15 R<sup>7</sup> is hydrogen or C<sub>1-4</sub> alkyl;

R<sup>11</sup> is hydrogen or C<sub>1-6</sub> alkyl and R<sup>12</sup> is C<sub>1-6</sub> alkyl; or R<sup>11</sup> and R<sup>12</sup> together are C<sub>3-10</sub> alkylene; and

at least 0.1 mole percent of the total polyol content is a diol of the formula  $\text{HO-R}^4\text{-OH}$ , where  $\text{R}^4$  is the residue of a diol containing at least one functional group independently selected from amide, imide, urea, and urethane groups.

5 19. The polyorthoester of Claim 18 where at least one of the polyols is a polyol having more than two hydroxy functional groups.

20. A device for orthopedic restoration or tissue regeneration comprising a polyorthoester of Claim 1.

21. A bioerodible implant comprising a polyorthoester of Claim 1.

10 22. A pharmaceutical composition comprising:

- (a) an active agent; and
- (b) as a vehicle, the polyorthoester of Claim 1.

15 23. The pharmaceutical composition of Claim 22 where the fraction of the active agent is from 1% to 60% by weight of the composition.

24. The pharmaceutical composition of Claim 23 where the fraction of the active agent is from 5% to 30% by weight of the composition.

20 25. The pharmaceutical composition of Claim 22 where the active agent is selected from anti-infectives, antiseptics, steroids, therapeutic polypeptides, anti-inflammatory agents, cancer chemotherapeutic agents, narcotics, local anesthetics, antiangiogenic agents, vaccines, antigens, DNA, and antisense oligonucleotides.

25 26. The pharmaceutical composition of Claim 22 where the active agent is a therapeutic polypeptide.

27. The pharmaceutical composition of Claim 22 where the active agent is a local anesthetic.
28. The pharmaceutical composition of Claim 27 further comprising a glucocorticosteroid.
- 5 27. The pharmaceutical composition of Claim 22 where the active agent is an antiangiogenic agent.
30. The pharmaceutical composition of Claim 22 where the active agent is a cancer chemotherapeutic agent.
- 10 31. The pharmaceutical composition of Claim 22 where the active agent is an antibiotic.
32. The pharmaceutical composition of Claim 22 where the active agent is an anti-inflammatory agent.
- 15 33. A method of treating a disease state treatable by controlled release local administration of an active agent, comprising locally administering a therapeutically effective amount of the active agent in the form of a pharmaceutical composition of Claim 22.
- 20 34. The method of Claim 33 where the active agent is selected from anti-infectives, antiseptics, steroids, therapeutic polypeptides, anti-inflammatory agents, cancer chemotherapeutic agents, narcotics, local anesthetics, antiangiogenic agents, vaccines, antigens, DNA, and antisense oligonucleotides.
- 25 35. A method of preventing or relieving local pain at a site in a mammal, comprising administering to the site a therapeutically effective amount of a local anesthetic in the form of a pharmaceutically acceptable composition of Claim 22.